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OF  
DENTAL RESIDENTS' RESEARCH PROJECTS  
AND LITERATURE REVIEWS  
1991**

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Samuel P. Davis, Lieutenant Colonel, USAF, DC

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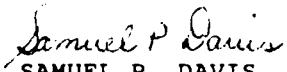
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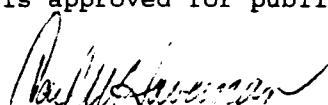
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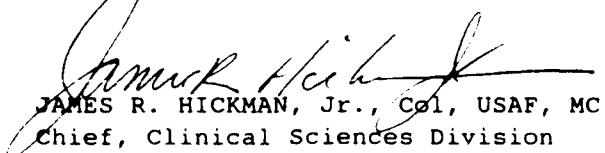
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This report has been reviewed and is approved for publication.

  
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## PREFACE

### ABOUT THE COMPENDIUM

The Compendium of Dental Residents' Research Projects was recommended to the USAF Dental Education Committee in 1986 as a way to preserve the research efforts of U.S. Air Force dental residents.

This collection of abstracts provides a synopsis of research projects completed by graduates of United States Air Force residency programs. The projects were undertaken in partial fulfillment of the requirements of the training programs.

The opinions and assertions contained in the abstracts are those of the writers and are not to be construed as official, or as reflecting the views of the Department of the Air Force.

### USING THE COMPENDIUM

The Table of Contents contains a numbering system to aid the reader in finding titles arranged according to discipline and year of presentation. The first two digits represent the year the thesis was written. The second two digits represent the 98XX specialty discipline:

- 9826 - General dentistry
- 9836 - Oral and maxillofacial surgery
- 9846 - Periodontics
- 9856 - Prosthodontics
- 9866 - Orthodontics
- 9876 - Oral pathology
- 9886 - Endodontics
- 9896 - Pedodontics

The last two digits are for our accounting.

The Table of Contents lists the title of the thesis followed by the name of the primary author and the page number where an abstract of the thesis may be found. The names of secondary authors are listed with the abstracts.

We are providing a bibliography of Previous Titles. This section lists the titles according to the general category of their content. Within a category you'll find the titles listed alphabetically by author. If an abstract was provided in a previous edition of the Compendium, it will be in parentheses, as will be the year of publication.

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Copies of General Practice Residency (GPR) literature reviews are not kept on file, but their titles are listed here. Direct any inquiries concerning the authors of literature reviews to the address above.

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91-26-01

THE SHEAR BOND TEST METHOD: EFFECT OF BLADE DESIGN

D. A. Shalkey, Major, USAF, DC

A wire loop plus ten different stainless steel shear blades were used to fracture uniform acrylic rods on an Instron Model 1125 (Canton, Mass.) Mean shear strength of the acrylic rod and standard deviation were determined for each blade design. Shear strength values varied among the groups, with the sharper blades producing lower values. Concentration of forces at the contact area between the blade and the specimen may explain the lower means seen with the sharper blade designs. Consistency of results as measured by standard deviation also varied with blade design. The knife-edged straight shear blade is one of the most common methods reported in the dental materials literature. However, this design not only had one of the highest standard deviations in this study, but also showed a visually observable buckling after only ten shear tests. The loose fitting circular 1-mm thick shear plate may be the best method because it showed one of the lowest variabilities; it could be used on specimens of various diameters without modification; and it should be more resistant to structural deformation than the straight knife-edged shear blade.

91-26-02

MECHANICAL PROPERTIES OF SEVEN DENTAL BASE MATERIALS

B. A. Lewis, Major, USAF, DC

The compressive strengths and compressive moduli of seven base materials (Dycal, VLC Dycal, Timeline, Vitrabond, Ketac Bond, Fuji Lining LC, XR-Ionomer) were measured at 7 minutes, 24 hours, and 90 days using 9 x 4-mm cylindrical specimens prepared in hollow Teflon tubes. The 24-hour and 90-day specimens were maintained for 1 hour at 37°C with relative humidity greater than 30%, then placed in distilled water at 37°C until testing. After grinding the ends of the specimens flat, the cylinders of base material were loaded at 1.0 mm/min in an Instron. The compressive strengths of Timeline, a resin based material, at 7 minutes, 24 hours, and 90 days were not significantly different. Timeline had significantly greater compressive strengths at all time periods than the other six base materials. The compressive strength of both Dycal and VLC Dycal decreased significantly between the 24-hour and 90-day periods. Of the three photosensitive GI base/liners tested, Fuji Lining LC had significantly higher compressive strengths in all three time periods. At 7 minutes, Timeline demonstrated a significantly higher compressive modulus than any other product. Ketac Bond had a significantly higher compressive modulus at 24 hours and 90 days.

91-26-03

EFFICACY OF VARIOUS SPRAY DISINFECTANTS ON ALGINATE IMPRESSIONS

H. S. Westerholm II, Lt Col, USAF, DC  
D. V. Bradley, Jr., Major, USAF, BSC  
R. S. Schwartz, Lt Col, USAFR, DC

Following the ADA-recommended disinfection procedure, the effectiveness of eight disinfectant solutions and a control (sterile water) was tested by spraying them on alginate impressions contaminated with Staphylococcus aureus, Mycobacterium phlei, Bacillus subtilis, or normal mixed oral flora. In Part I, alginate impressions were made of a metal typodont contaminated with bacteria from one of the three test organisms. In Part II, one alginate impression each was made of the maxillary and mandibular arches of 16 volunteers. Each impression was cultured at two standard sites prior to disinfection and at four standard sites after disinfection. Mean pre- and post-disinfection CFU counts were obtained for each microorganism after the appropriate contact time. Alcide LD, OMC II, Biocide, and Professional Lysol Spray were unable to achieve a  $4\text{-log}_{10}$  (99.99%) reduction of any of the microorganisms under the test conditions. Sporicidin and 0.525% sodium hypochlorite were able to effect a  $4\text{-log}_{10}$  reduction against S. aureus only. Impresept and 5.25% sodium hypochlorite did achieve a  $4\text{-log}_{10}$  reduction in bacterial counts in all cases except against B. subtilis. Possible effects of these disinfectants on the accuracy, dimensional stability, and surface detail reproduction of alginate impressions is currently unknown and warrants investigation. Full strength (5.25%) sodium hypochlorite was effective in the shortest contact time (1 minute).

91-26-04

MOLAR EFFICIENCY USING ELECTRON-WITHDRAWING NPG SUBSTITUTES  
IN DENTIN BONDING

N. J. Miniotis, Major, USAF, DC

The purpose of this study was to evaluate and compare the dentin adhesive bonding efficiency of electron-deficient N-phenylglycine (NPG) analogs. The substituted amino acids (N-compounds) used were the following: N-(4-chlorophenyl)-glycine (NCPG) and N-(3, 4-dichlorophenyl)-glycine (NDLCPG). A three-step dentin bonding protocol was employed. The first step, treatment of the dentin surface with an acidic ferric oxalate solution, and the third step, the application of a surface-active comonomer, were held constant throughout the study. In the second step, the amount of N-compound (NCPG, NMNCPG, or NDCPG) was varied in acetone from 0.0 mol/L to 0.5 mol/L in ten steps. Average tensile bond strengths (TBS) were measured and analyzed for group variance equality with the Bartlett's M-statistical test. Data with the same variance were subsequently ranked by the Duncan's Multiple Range test. Because of variance inequality within the efficiency values, molar efficiency

values were compared between each concentration applied for each molecule and for the same concentration between molecules by the Fisher-Behrens test. NMNCPG had the highest bond strength at the lower and middle concentrations and was significantly different ( $p<0.05$ ) than NCPG and NDCPG at  $1 \times 10^{-3}$  mol/L. NMNCPG and NCPG were different ( $p<0.05$ ) than NDCPG at  $5 \times 10^{-4}$  mol/L, and  $1 \times 10^{-2}$  mol/L. Molar efficiency was highest at the lower concentrations for NMNCPG and NCPG. Increasing electron deficiency of NCPG by the addition of a second chlorine atom to form NDCPG decreased bonding tensile strength and narrowed the effective concentration range for bonding. The tertiary amine NMNCPG was efficient over a broader range of concentrations than the secondary amines NCPG and NDCPG and the least sensitive to operator error.

91-26-05

INFLUENCE OF CURING TIME AND DISTANCE ON MICROHARDNESS OF  
EIGHT LIGHT-CURED LINERS

D. F. Murchison, Major, USAF, DC

Eight visible light-activated liners were evaluated to assess degree of polymerization by microhardness comparison. Knoop hardness number (KHN) values were measured on 1.0-mm thick specimens with varied exposure times (20, 40, 60 seconds) and distances from the curing source (0, 3, 6 mm). Statistical analysis of the nine groups within each material revealed significant differences for time and distance ( $p<0.05$ ). Application of the light for at least 40 seconds resulted in significantly higher KHNs than specimens cured for 20 seconds. The highest KHNs were obtained when the tip of the light source was 3 mm away from the light-activated liner.

91-26-06

XR BOND SHEAR STRENGTHS OBTAINED WITH  
FOUR DENTIN SURFACE TREATMENTS

M. A. McHenry, Lt Col, USAF, DC

Different dentin surface treatments have been recommended that may affect the bond strength of a dentin bonding agent. This study examined the shear bond strength of a composite resin to dentin that had four different treatments applied. A flat dentin surface on 80 extracted human third molars was obtained and the teeth divided into four groups. A 3.25-mm diameter circle of dentin was isolated with Teflon tape and the surface treatments applied. A cylinder of Herculite XR composite resin was applied to the treated surface and light-cured for 120 seconds. The dentin-composite resin interface was loaded in shear in an Instron at a crosshead speed of 5 mm/min until failure. Means and SDs were as follows:

SURFACE TREATMENT/APPLICATION TIME	SHEAR BOND STRENGTH (MPa)
Intact smear layer	8.02 $\pm$ 2.91
XR Primer, CONTROL (30 sec)	11.10 $\pm$ 6.19
Phosphoric acid gel (37%, 20 sec)	6.82 $\pm$ 4.31
Tenure Dentin Conditioner (60 sec)	8.44 $\pm$ 3.04

Using an analysis of variance and Tukey's B post-hoc test, the control group (XR Primer) was significantly stronger in shear ( $p<.05$ ) than the phosphoric acid group. All other groups were statistically similar in strength. The mode of failure varied widely with no clear pattern of adhesive or cohesive failure.

91-26-07

#### APICAL EXTRUSION OF GUTTA-PERCHA WITH FIVE OBTURATION TECHNIQUES

D. J. Ammon, Major, USAF, DC

There is concern that thermoplasticized gutta-percha obturation techniques may result in extrusion of filling material beyond the apical foramen. The purpose of this in-vitro study was to compare the amount of gutta-percha extrusion among five different obturation techniques in the presence of three different apical opening sizes. In the study, 150 single-canal roots from extracted human teeth were divided into three groups of 50 roots with patent apical openings of 0.10, 0.25, or 0.40 mm. The canals were instrumented in a standardized manner. Ten roots from each group were obturated with gutta-percha using one of five methods: lateral condensation, lateral condensation with Endotec, Thermafil, Obtura, or Ultrafil. Extruded gutta-percha was collected and weighed on an analytical balance. Data was analyzed with an analysis of variance and post-hoc Scheffe test. Obturation with Ultrafil resulted in a significantly greater amount of gutta-percha extrusion at all three apical opening sizes ( $p<.05$ ). There was no statistical difference in the amount of extrusion among lateral condensation, Endotec, Thermafil, and Obtura in the presence of a 0.10- or 0.25-mm apical opening. With a 0.40-mm apical opening present, Obtura displayed significantly more extrusion than lateral condensation or Endotec.

91-26-08

#### TENSILE STRENGTH OF RESIN CEMENTS WITH VARIOUS ALLOY SURFACE TREATMENTS

T. A. Imbery, Maj, USAF, DC  
J. O. Burgess, Col, USAF, DC  
W. P. Naylor, Lt Col, USAF, DC

Resin bonded retainers rely on an etched base metal alloy for micromechanical retention. This study compared 2 alloy surface treatments on 2 metal ceramic alloys with 3 resin cements. One hundred-forty Rexillium III (R) and

120 Olympia (O) disks were cast, oxidized, and given 5 simulated porcelain firings. Paired specimens were cemented with Comspan (C), Panavia EX (P), or C & B Metabond (M) after air-abrasion with aluminous oxide (A) or silicoating (S). Air-abraded O disks were tin-plated prior to cementation with P. Electrolytically (E) etched R specimens cemented with C served as controls. Specimens were thermocycled 500 times and tested in tension. Tensile strength (MPa) results were: (1) RAC=5.24 (2) RAP=11.20 (3) RAM=12.91 (4) RSC=12.53 (5) RSP=12.64 (6) RSM=14.61 (7) OAC=5.10 (8) OAP=16.47 (9) OAM=11.65 (10) OSC=10.76 (11) OSP=6.27 (12) OSM=10.76 (13) REC=9.40 (control). A 3-way analysis of variance, Tukey's B-test, and Dunnett's comparison test indicated that Groups OSM, OSC, RAP, and OAM were not statistically different from the control. The tensile bond strengths of Groups OAC, RAC, and OSP were significantly lower than the control, while the strengths of RSC, RSP, RAM, RSM, and OAP were significantly higher ( $P<0.05$ ); OAP achieved the highest strength. Compared to etched R, the tensile bond strengths of air-abraded O and R varied significantly with cement selection, while silicoated R had significantly higher bond strengths than silicoated O regardless of the type of cement used.

91-26-09

THE EFFECT OF SURFACE COATING ON COLOR AND FLEXURAL STRENGTH  
OF GLASS IONOMER CEMENT

C. B. Hermesch, Lt Col, USAF, DC

Operators commonly face 2 problems when using glass ionomer restorative materials. First, shade selection is complicated by the apparent mismatch between newly placed glass ionomer restoration's color and its ultimate color. Second, glass ionomer's range of restorative uses is limited by its low strength. This lab study examined the effects that 2 waterproofing surface coating agents had on glass ionomer's color change and flexural strength over 6 months. Considerable color change (measured via colorimeter) was found to occur for at least 1 month in both coated and uncoated specimens. The coated glass ionomer specimens had significantly higher strength than uncoated control specimens. The waterproofing surface coating agents prevent water flow (hydration or dehydration) and result in more complete maturation of the glass ionomer setting reaction. This study infers the importance of the clinical use of waterproofing surface coating agents to maximize the strength of glass ionomer. The materials used in the study were Ketac-Fil, Ketac Varnish, and Ketac Glaze (ESPE Premier). The Ketac Glaze was equal but not superior to Ketac Varnish in terms of the glass ionomer's color change and flexural strength.

91-26-10

## MICROBIOLOGICAL CONTAMINATION DURING DENTAL RADIOGRAPH PROCESSING

D. A. Stanczyk, Major, USAF, DC

This study investigated microbiological contamination of an automatic dental radiograph processor and daylight loader during a week of simulated clinical use. Pure cultures of Candida albicans, Streptococcus pneumoniae, Staphylococcus aureus, or Klebsiella pneumoniae were used to contaminate 320 vinyl intraoral radiograph packets. The end of the films were deliberately contaminated during opening. These films and 24 uncontaminated control films were processed. Daylight loader ports, inlet and outlet rollers, fixer and developer samples and 12 processed films were cultured daily. To simulate a weekend, the processor sites were cultured during 72 hours of inactivity following the contaminated runs. Results: (1) Daylight loader ports and inlet rollers became contaminated with C. albicans, K. pneumoniae, and S. aureus, but had no growth after 72 hours of inactivity. (2) Outlet rollers became contaminated with S. aureus, but had no growth after 24 hours of inactivity. (3) 94% of processed films and 100% of control films became contaminated with S. aureus. After 72 hours of inactivity no control films became contaminated. (4) C. albicans was cultured from 10% of processed films. Conclusions: (1) Contamination of the processor occurred. (2) Films may remain contaminated after processing. (3) Cross-contamination of films occurred in the processor. (4) The processor and daylight loader remained contaminated for at least 48 hours of inactivity.

91-26-11

## THE INCIDENCE OF SERUM BACTEREMIA FOLLOWING TREATMENT WITH THE CAVI-MED 100 SYSTEM

J. P. Ramer, Major, USAF, DC  
G. S. Graham, Lt Col, USAF, DC  
K. L. Lindell, Major, USAF, DC  
J. C. Broome, Lt Col, USAF, DC

The purpose of this investigation was to evaluate the incidence of bacteremia following periodontal pocket treatment and intrasulcular irrigation with the Cavi-Med 200 System (Dentsply Int., York, PA). Two irrigation solutions were compared: sterile water and Pro-Sol CHX (Dentsply Int., York, PA), a 0.12% chlorhexidine solution. Twenty patients with periodontal pockets in at least two sextants of the mouth were studied. The pockets were at least 5-mm deep and bled on probing. The study was accomplished using a split mouth design with treatment appointments 2 weeks apart. Selection of irrigant and quadrant was randomized. Treatment time for each sextant was 15 minutes. Pre-op and post-op venous blood samples were cultured for aerobic and anaerobic organisms. The results demonstrated an incidence of bacteremia of 20% for irrigation with sterile water and 15% for Pro-Sol CHX. The average colony count for positive patients with samples cultured on blood agar was 0.33

cfu/cc for sterile water and 0.1 cfu/cc for Pro-Sol CHX. Three out of the four patients who incurred a bacteremia did so for both treatment groups. A McNemar's chi-square test showed no significant difference between the treatment groups. The results suggest that the use of a chlorhexidine irrigant during periodontal pocket treatment may not significantly influence the incidence of bacteremia.

91-36-01

SIMULTANEOUS SPLIT-THICKNESS SKIN GRAFTING AND PLACEMENT OF  
ENDOSTEAL IMPLANTS IN THE EDENTULOUS MANDIBLE

W. G. Hughes, Major, USAF, DC

Reconstruction of the edentulous atrophic mandible continues to be a treatment problem for the oral and maxillofacial surgeon. Clearly, endosteal osseointegrated implants are indicated for rehabilitation, but a total implant supported prosthesis may not always be possible. The implant supported overdenture is an excellent alternative, but modifications of the unfavorable residual ridge may be necessary. Attached crestal soft tissue, resistant to mechanical trauma, and improvement of the residual ridge anatomy is provided by adding a split-thickness skin graft vestibuloplasty (VSG) and by lowering the floor of mouth (LFM). Simultaneous VSG and LFM with placement of endosteal implants provides the optimal condition for maximal rehabilitation of the atrophic mandible with specific indications. We present our results of 4 skin grafts and 8 implants simultaneously placed without failure of either system.

91-46-01

THE EFFECTS OF THE Nd:YAG LASER ON IN-VITRO FIBROBLAST  
ATTACHMENT TO ENDOTOXIN-TREATED ROOT SURFACES

D. J. Trylovich, Major, USAF, DC

The purpose of this study was to evaluate the effects of the Nd:YAG laser on in-vitro fibroblast attachment to endotoxin treated root surfaces and to describe any laser-induced cementum surface alterations. Thirty 4 x 4-mm cementum segments were obtained from unerupted third molars. The treatment groups were as follows: (1) control: no treatment; (2) non-lased, endotoxin-treated; and (3) lased, endotoxin treated. The endotoxin-treated roots were soaked in Escherichia coli 055:B5 lipopolysaccharide (556 EU/ml) for 72 hours. The lased, endotoxin treated root segments were lased with an Nd:YAG laser for 1 minute. The root segments were subsequently placed in fibroblast culture dishes for 40 hours and then prepared for scanning electron microscopy (SEM). SEM examination revealed two different types of fibroblast attachment: flat and round. Flat cells represented firmly-attached cells due to well-defined points of attached and numerous lamellopoda. Round cells possessed few attachment processes and were, therefore, considered poorly attached. The lased, endotoxin-treated root segments had significantly decreased numbers of

flat fibroblasts versus the control and non-lased, endotoxin-treated root segments. The absence of flat fibroblasts in the laser-treated root segments was a consistent finding. The non-lased, endotoxin-treated root segments had significantly increased numbers of round fibroblasts versus the control and lased, endotoxin-treated groups. The lased root segments exhibited surface alterations which included charring, crater formation, cementum meltdown, and tracking. The organic matrix appeared to have been burned off leaving behind a resolidified substance with a lava-like appearance. The results of this study suggest that the laser alters the biocompatibility of the cementum surface making it unfavorable for fibroblast attachment.

91-46-02

#### EXPERIMENTAL MODEL FOR THE STUDY OF PERIODONTAL WOUND HEALING

R. R. Burnett, Major, USAF, DC

In order to evaluate the influence of biologic mediators on the regenerative capabilities of the periodontium, it is essential to establish a baseline for wound healing events in the absence of disease. This pilot study utilized a fenestration wound model in 4 primates (Macaca mulatta). Each animal received 2 surgeries where defects were created into the dentin through the alveolar bone at the mid-root level in 8 sites/arch. Titanium (Ti) screws were placed in 50% of the sites with the screw head flush with the surrounding root surface. At the initial surgery, some sites were covered with a Teflon membrane. Similar treatment was performed in the opposite arch 15 weeks later utilizing a collagen membrane with or without TGF-B growth factor. The animals were sacrificed 5 weeks after the second surgery (20 weeks after the initial surgery). The following histological observations were made: (1) 20-week Ti sections with and without a Teflon membrane had cementum-like material, "cementointegration," on the surface of the screws; (2) 20-week non-Ti sections with and without Teflon membranes demonstrated complete healing with cementum, a perpendicular-oriented periodontal ligament (PDL), and bone covering the defects; (3) a foreign body giant cell reaction was present adjacent to the Teflon membrane; (4) 5 week sections demonstrated cementum, a parallel-oriented PDL, and bone covering the defects with no apparent differences at this time period between the use of collagen membranes with or without TGF-B. These results suggest that the fenestration wound model in a nonhuman primate allows the assessment of normal wound healing events. The observation of healing events in the absence of disease provides a predictable model for evaluating optimal effects of various procedures on the healing of the periodontium. Earlier time periods should be evaluated to characterize initial events leading to regeneration of the periodontium.

## SERUM ANTIBODY RESPONSES TO ORAL MICROORGANISMS IN NONHUMAN PRIMATES

A. G. Giardino, Major, USAF, DC

Porphyromonas gingivalis and Prevotella intermedia have been associated with periodontitis in humans and nonhuman primates (NhP). This investigation characterized serum antibody levels, isotypes and subclass distribution and specificity to P. gingivalis, P. intermedia, and Bacteroides fragilis prior to, and after immunization with these bacteria and during ligature-induced periodontitis. Serum from 20 adult, female cynomolgus monkeys was obtained at baseline, after 3 intramuscular injections with  $10^9$  bacteria emulsified in incomplete Freund's adjuvant (IFA) or with IFA, and during 30 weeks of ligature placement. IgG, IgM, and IgA isotypes and IgG1<sup>-4</sup> subclass antibody were assessed in an ELISA. Baseline levels of IgG/M/A antibody were 4-20 fold higher to P. intermedia (90/20/20 EU) than to P. gingivalis (26/5/1/EU) in the NhP. Immunization increased IgG/M/A antibody by 16-260 fold to P. gingivalis (389/102/263 EU) and 5-70 fold to P. intermedia (948/534/1411 EU). IgM/A responses subsided by 8-13 weeks post-immunization, while IgG was maintained through 25-30 weeks. Negligible cross-reactivity was detected except for a 3-fold increase in IgM antibody to P. intermedia in the P. gingivalis or B. fragilis immunized groups. No detectable changes were noted in IgG/M/A antibody to P. gingivalis or P. intermedia in any group following ligation. Nearly 75% of natural IgG antibody was comprised of IgG1 to P. gingivalis and P. intermedia, while IgG3 (62%) and IgG2 (33%) predominated to B. fragilis. The IgG response to P. gingivalis and P. intermedia after immunization was comprised primarily of IgG1 (86-98%), IgG2=IgG4 (4-10%) and minimal IgG3. Anti-B. fragilis responses were IgG1 (49%), IgG2=IgG3 (18-21%) and IgG4 (12%). These results demonstrate the ability to induce a highly specific antibody response in NhP following immunization with oral microorganisms. While all isotypes were elicited, only the IgG antibody was maintained through the ligation interval. The natural and induced IgG response to oral bacteria was primarily IgG1.

## SALIVARY PAF LEVELS IN PERIODONTAL DISEASE

M. L. Garito, Major, USAF

Platelet activating factor (PAF), a potent phospholipid inflammatory mediator has been found to be present in normal human saliva; however, its contribution to oral pathobiology remains unknown. The purpose of this study was to evaluate possible relationships between salivary PAF levels and periodontal disease. One ml of mixed saliva was collected from 69 untreated subjects presenting for evaluation at the UTHSC dental hygiene or periodontal

clinic. After phospholipid extraction and fractionation by thin layer chromatography, salivary PAF activity was determined by platelet bioassay. PAF activity was estimated relative to that of authentic PAF (1-O-hexadecyl-2-acetyl-sn-glycero-3-phosphocholine [C16:0-AGEPC]) and was expressed in C16:0-AGEPC fmole equivalents/ml saliva; tracer amounts of  $^3\text{H}$ -AGEPC were included in all samples prior to initial extraction and used to calculate PAF recovery. Subjects were subdivided into 6 similarly-sized groups according to disease severity (based on probing depths). The healthiest group, Group 1, had  $\leq$  4 mm probing depths throughout, while the most severely affected group, Group 6, averaged  $>$  4 mm probing depths in 50% of the sites. No significant differences were noted between the groups for age, sex, or number of teeth. A correlation was found between the number of bleeding sites and the 6 groups. PAF levels generally increased from Group 1 to Group 6; Group 1 levels ( $2,365 \pm \text{SE}$ ) were significantly lower than Groups 5 and 6 ( $10,489 \pm 3,075$ , respectively). These findings indicate that salivary PAF levels correlate with periodontal status and suggest that this phospholipid inflammatory mediator may play a role in the pathogenesis of periodontal disease.

91-56-01

AN EVALUATION OF THE MARGINAL SHARPNESS OF THE PORCELAIN LABIAL  
MARGIN METAL CERAMIC RESTORATION

J. J. Boyle, Major, USAF, DC

The porcelain labial margin metal ceramic crown has emerged as a popular alternative to the conventional metal ceramic restoration. Although several methods of fabrication exist, the platinum foil technique is considered to produce an acceptable marginal opening with a sharp labial margin.

In recent years, the direct-lift technique has gained popularity owing to its ease of fabrication. While the direct-lift method produces an acceptable marginal opening, it can also produce a more rounded labial margin. This rounding phenomenon can result in an unwanted "gap" at the porcelain-tooth interface.

The introduction of high-fusing shoulder porcelains offers an improved technique and a porcelain margin material reportedly stable at high temperature. However, this claim of high temperature stability remains to be substantiated. Studies have reported the existence of marginal rounding without directly measuring the rounding.

Therefore, this investigation was designed to: (1) develop a technique to actually measure porcelain margin sharpness using computer technology; (2) evaluate the accuracy and marginal sharpness of the high-fusing shoulder porcelains with the direct-lift technique; and (3) evaluate the marginal opening and adaptation of the shoulder materials to the master die shoulder. Ten wax patterns of a standardized substructure were injection molded, cast in a gold-palladium alloy (Olympia), finished, oxidized, and opaqued. Then porcelain labial margin crowns were fabricated with three techniques: (1)

platinum foil technique using Vita VMK 68 body porcelain; (2) direct-lift technique using Vita VMK 68 high-fusing shoulder porcelain; and (3) direct-lift technique using Vita SM 90 thermoplastic shoulder porcelain. Ten specimens were made for each treatment group and measured in nine locations. Standardized 40x photographs were scanned into a computer. The external labial margin of the specimens was outlined and the area of rounding computed using the software program, MacDraft. The remaining sites were measured with a measuring microscope and the data analyzed using a one-way analysis of variance followed by a Tukey's multiple comparison test ( $p<0.05$ ).

A comparison of the data revealed the following:

1. The two-direct lift techniques produced significantly smaller facial marginal openings (high-fusing shoulder porcelain =  $8.2 \pm 2.0 \mu\text{m}$  and SM 90 =  $11.3 \pm 4.6 \mu\text{m}$ ) than the platinum foil technique ( $13.7 \pm 4.6 \mu\text{m}$ ).
2. SM 90 specimens had a significantly greater internal opening  $134.4 \pm 50.3 \mu\text{m}$  in cross-section.
3. High-fusing shoulder porcelain ( $55.7 \pm 81.2 \text{mm}^2$ ) and SM 90 ( $48.9 \pm 26.8 \text{mm}^2$ ) both produced a porcelain labial margin sharpness not statistically different from the platinum foil technique ( $22.1 \pm 30.8 \text{mm}^2$ ) although their variability was greater.
4. Positive and negative marginal rounding occurred with high-fusing shoulder porcelain and SM 90 producing specimens that were accurate and stable enough to follow the external rounding of the gypsum dies. This "positive" rounding, or overextended porcelain "tag," could prevent complete seating of the clinical crown.

Given evidence of "positive" rounding, the success of the porcelain labial margin may lie more with the ability of the die materials to reproduce the prepared tooth rather than with variations in technique or the dimensional change of the margin materials themselves.

91-66-01

#### ELASTOMERIC LIGATURES IN ORTHODONTICS

J. M. Crouse, Major, USAF, DC

Elastomeric ligatures are a very popular means of securing an archwire into a bracket slot. However, there is some question regarding their performance over time. In this study, elastomeric ligatures were tested to determine the following: (1) How much strength do elastomeric ligatures have when stretched 3, 5, and 7 mm to simulate use on different types of brackets? (2) How much does the strength degrade over 4 weeks? (3) Is there a difference between injected and chopped, clear and gray, different diameters, and different manufacturers of elastomers? Clear and gray samples of the following products were examined: Unitek A-1 Alastiks, Ormco 110 and 120 Power-O

modules, and Ormco Ormolast 110 Power-Os. Ten samples of each were stretched on stainless steel pins mounted in acrylic blocks at the designated distances and stored in distilled and deionized water at 98°F. The samples were tested without prior stretching, at 1 hour, 10 hours, 24 hours, 2 weeks, and 4 weeks by stretching the appropriate distance using lead pellets poured in a cup that was then weighed on an electronic scale to the nearest gram. Initially, the ligatures exerted between 280 and 445 grams at 3-mm, 510 to 720 grams at 5-mm, and 670 to 1200 grams at 7-mm stretches. The strengths of all products tested deteriorated rapidly after the first hour; however, after 10 hours they stayed fairly constant for the remaining 4 weeks. The amount of force loss was between 40% and 80%. The ligatures are all adequate at the different amounts of stretch. There may be some advantage to using injected over chopped ligatures in some situations. There are some differences between clear and gray ligatures that varied depending on the different types, stretches, and times. The different diameters were essentially the same after 4 weeks. There was little difference between the two brands of ligatures.

91-86-01

THE SOLVENT EFFECTS OF CALCIUM HYDROXIDE IRRIGATING SOLUTION  
ON BOVINE PULP TISSUE

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D. L. Carnes, Jr., Ph.D.  
S. Montgomery, D.D.S., F.A.C.D.

The solvent effects of calcium hydroxide irrigating solution (used alone and in combination with sodium hypochlorite) on bovine pulp tissue were studied. Forty, 90-mg pieces of pulp tissues were treated with calcium hydroxide solution alone, calcium hydroxide and sodium hypochlorite alternated, sodium hypochlorite alone, and saline alone. Each piece of tissue was treated for 32 minutes. Desiccated pretreatment and post-treatment weights were compared. There was no significant difference between the dissolution capability of calcium hydroxide solution used alone and saline alone. No significant difference was noted between calcium hydroxide solution and sodium hypochlorite used alternately, and sodium hypochlorite used alone. However, both of these groups were significantly more effective at dissolving tissue than calcium hydroxide solution alone or saline alone. Calcium hydroxide solution was an ineffective solvent of pulpal tissue. If tissue dissolution is desired during root canal therapy, the use of calcium hydroxide solution as the sole irrigant is no more effective than saline.

A COMPARISON OF WEIGHTS OF DEBRIS EXTRUDED APICALLY BY  
CONVENTIONAL FILING AND CANAL MASTER TECHNIQUES

G. L. Myers, Major, USAF, DC

Sixty extracted human teeth were divided into 3 groups of 20 each. Apically-extruded debris and irrigant were collected, dried, and weighed by the following three instrumentation techniques: (a) Group 1 - filing 1-mm short of the foramen; (b) Group 2 - Canal Master instrumentation to the foramen; and (c) Group 3 - filing to the foramen (for a relative comparison). The results indicated that all three groups were significantly different from one another. Group 1 had the least amount of debris extruded. Of the two groups instrumented to the foramen, Group 3 had twice as much debris extruded as Group 2. An apical dentinal plug was frequently found in Group 1 and was probably a major reason why this group had the least amount of extruded debris. The significance of this dentinal plug and possible indications for instrumentation to the foramen are discussed.

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1. Bolling Air Force Base DC.

Det 1, Malcolm Grow USAF Medical Center/Col Paul K. Blaser, Director.

a. Splint Therapy, 26 Jul 91, Scott A. Broadbent, Captain, USAF, DC.

b. Etiological Factors Affecting the Incidence of Localized Alveolar Osteitis, 26 Jul 91, Lee A. Fulsaas, Captain, USAF, DC.

c. Second Generation Dentin Bonding Agents, 26 Jul 91, Grant H. Schneider, Captain, USAF, DC.

d. Post and Cores, 26 Jul 91, Todd E. Wynkoop, Captain, USAF, DC.

2. Chanute Air Force Base IL.

Chanute TTC Hospital/Lt Col Lawrence D. Schmeltzer, Director

a. Dental Management of the Patient with a Bleeding Disorder: Review and Update, 15 Jul 91, Edward L. Clark, Captain, USAF, DC.

b. Immunologic Aspects of Periodontal Disease, 15 Jul 91, Elizabeth L. Grys, Captain, USAF, DC.

c. Anterior Full Coverage Restorations: A Comparison of Systems, 15 Jul 91, Paul R. Niesen, Captain, USAF, DC.

d. Dental Management of the Diabetic Patient, 24 Jul 91, Scott R. Schbukegel, Captain, USAF, DC.

3. Davis-Monthan Air Force Base AZ.

836th Medical Group/Lt Col Robert A. Olson, Director.

a. Guided Tissue Regeneration, 22 Jul 91, James B. Hanigan, Captain, USAF, DC.

b. Dicor Veneers, 22 Jul 91, Thomas J. Murphy, Captain, USAF, DC.

c. Home Bleaching, 22 Jul 91, Richard L. Omans, Captain, USAF, DC.

d. Nonsteroidal Anti-Inflammatory Drugs, 22 Jul 91, Randel P. Swanson, Captain, USAF, DC.

4. Offutt Air Force Base NE.

Ehrling Bergquist Strategic Hospital/Col Frank A. Kyle, Jr., Director

a. The Electronic Apex Locator as a Useful Adjunct in Endodontic Therapy, Jun 91, Brian E. Bergeron, Captain, USAF, DC.

b. Orthodontic Extrusion: An Alternative to Surgical Crown Lengthening, Jun 91, John M. Conti, Captain, USAF, DC.

c. The Esthetic Hybrid Resin Bonded Bridge, Jun 91, Jeffrey F. Deluna, Captain, USAF, DC.

d. Bite Mark Analysis in Forensic Dentistry, Jun 91, Robert E. Langsten, Captain, USAF, DC.

e. Retrofilling Materials: A Review of the Literature, Jun 91, Michael J. Mauger, Captain, USAF, DC.

f. Root Sensitivity Mechanisms and Treatment Alternatives, Jun 91, David W. Murray, Captain, USAF, DC.

g. Gingival Curettage: Historical Review and Current Perspectives, Jun 91, Lowell W. Reither, Captain, USAF, DC. -

h. Behavior Management of Children in the Dental Office, Jun 91, Roderick D. Vansurksum, Captain, USAF, DC.

5. Scott Air Force Base IL.

USAF Medical Center Scott/Col William D. Theobold, Director.

a. A Review of Dentin Bonding Systems, 1991, James T. Eimer, Captain, USAF, DC.

b. Osseointegrated and Biointegrated Implants, 1991, Christopher H. Holland, Captain, USAF, DC.

c. Pathogenesis of Plaque Associated Periodontal Disease, 1991, Sonny S. Kim, Captain, USAF, DC.

d. Replantation of Avulsed Permanent Teeth, 1991, Allen W. Meier, Captain, USAF, DC.

6. Travis Air Force Base CA.

David Grant USAF Medical Center/Col Stanley M. Plies, Director.

a. Resilient Denture Liners: Historical Perspectives and a Modified Clinical Technique, 17 May 91, J. Owen Corwin, Captain, USAF, DC.

b. The Efficacy of Thermofil, 17 May 91, Jesse A. Grimm, Captain, USAF, DC.

c. Implant Tissue Reaction: Gingiva vs Skin, 17 May 91, Daniel S. Phillips, Captain, USAF, DC.

d. Osseous Regeneration Materials, 17 May 91, Kevin J. Rourk, Captain, USAF, DC.

7. Wright-Patterson Air Force Base OH.

USAF Medical Center Wright-Patterson/Col William R. Langenderfer, Director.

a. Dentist-Supervised at Home Tooth Bleaching, 2 Aug 91, Douglas E. Ford, Captain, USAF, DC.

b. Nonsteroidal Anti-Inflammatory Drugs, 2 Aug 91, John W. Gazzero,  
Captain, USAF, DC.

c. Claps Assemblies for Distal Extension RPDS, 2 Aug 91, Denver D.  
Jenkins, Jr., Captain, USAF, DC.

d. Pioneer Craniofacial Analysis for Orthodontics and Oral Maxillofacial  
Surgery, 2 Aug 91, C. Roger Zody II, Captain, USAF, DC.

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